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Risk Assessment and Disaster Prevention and Mitigation Strategies for Large-Scale Sediment Disasters

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Under climate change impact, the frequency of extreme hydrological events increases. The occurrence of extreme rainfall events may lead to large-scale flooding or sediment disasters resulting in serious property damage and casualties. Large-scale sediment disasters include large-scale landslides and debris flows which are the main types of disasters causing casualties. In Taiwan, during Typhoon Morakot in 2009, the long duration and high-intensity rainfall led to a large-scale sediment disaster resulting in heavy casualties. A disaster with certain magnitude and complexity cannot be coped with a single disaster management approach. In this study, a risk assessment method considering climate change impacts proposed by the Intergovernmental Panel on Climate Change (IPCC) was adopted. By analyzing hazard, exposure, and vulnerability indicators of large-scale sediment disasters in Xinfa catchment of Kaohsiung City, Taiwan, a disaster risk adaptation strategy was proposed based on the impact of disaster factors.

Two scenarios were applied for the catchment sediment hazards risk assessments including 50-year recurrence period (high frequency and low impact) and extreme scenario (low frequency and high impact). Multiple factors for hazard (impact area of landslides and debris flows), exposure (lifeline roads and land use intensity), and vulnerability (disaster prevention and relief resources and settlement population characteristics) assessments were considered. The correlation factor selection and weighting analysis was calibrated by the 2009 Typhoon Morakot event. All disaster-recorded locations were above moderate risk indicating that the risk assessment method was reasonable. A risk map for Xinfa catchment was completed based on the validated risk assessment model to identify the high-risk settlements. After analyzing the spatial characteristics and disaster risk impact factors of high-risk settlements, both software and hardware disaster prevention measures and adaptation strategies were suggested. According to the analyzed results, although the hardware measures were effective in reducing sediment hazards generally, under extreme hydrologic events, those measures could be ineffective due to limited protection capacity of the engineering facilities. Hence, reducing exposure and vulnerability is essential to deal with the impact of extreme events.

Keywords: **Large-scale sediment disasters, Risk assessment, Adaptation strategies**